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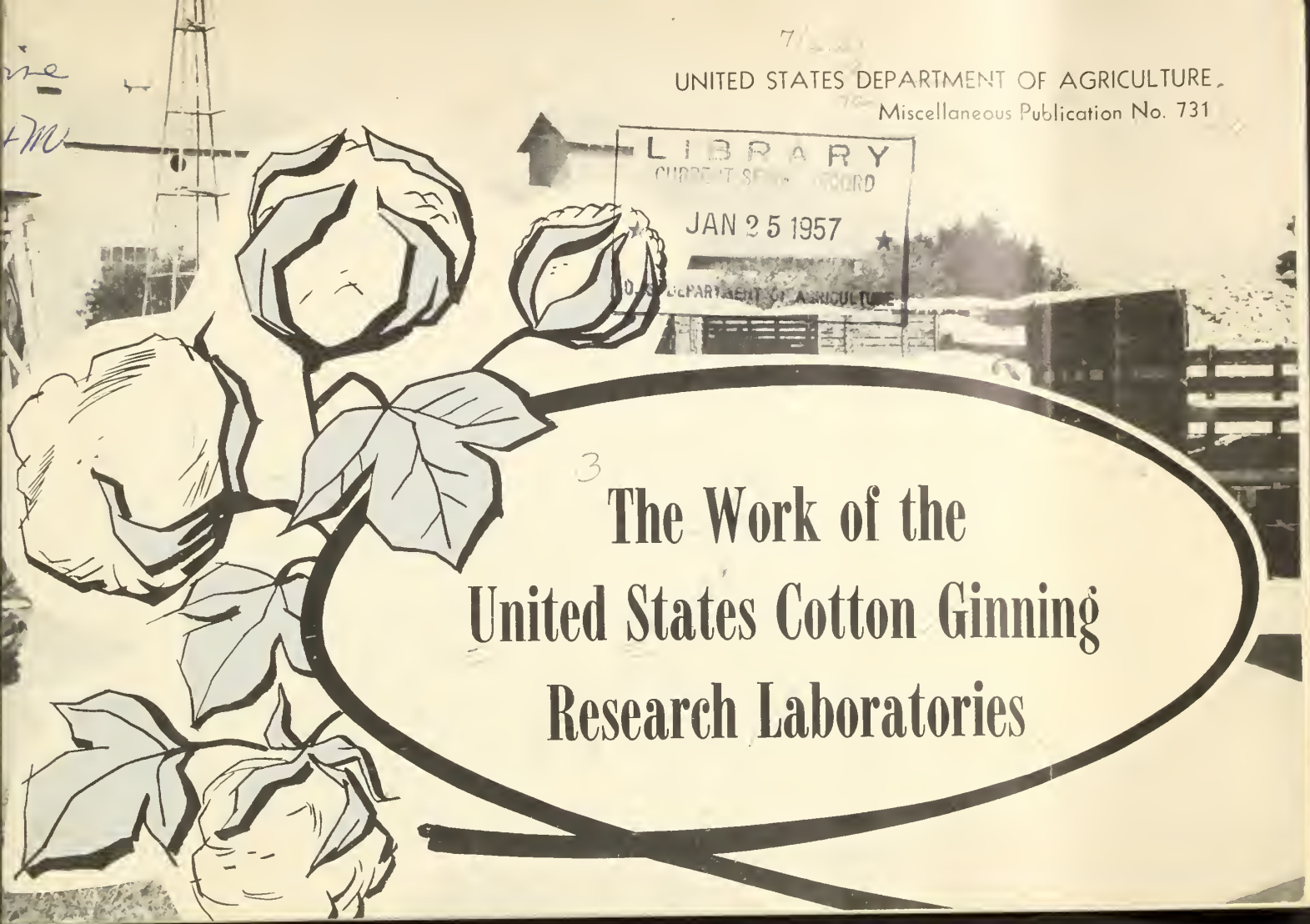

The Work of the United States Cotton Ginning Research Laboratories

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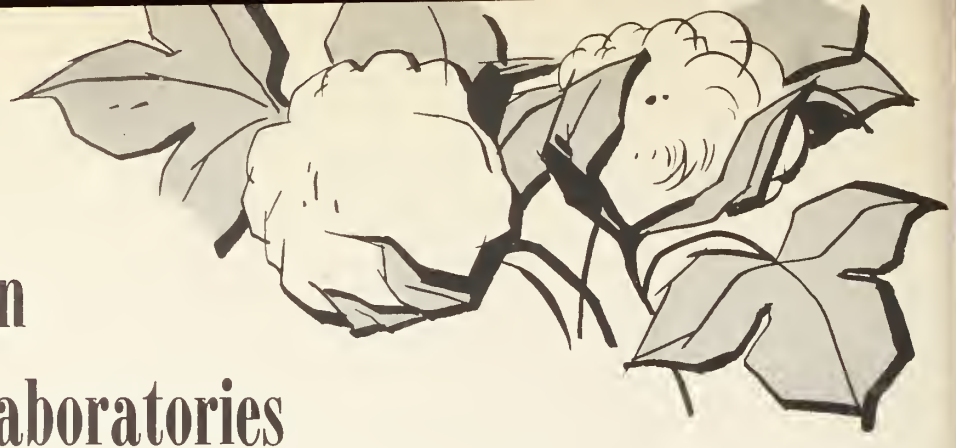

The American inventions of saw and improved roller gins for separating cotton lint (or fiber) from seed have made possible the production of cotton in many countries throughout the world.

Ginning is the last operation in cotton production. The cottongrower is as much concerned with this operation as with those that were under his control, because until it is completed he does not have a salable product. Cotton fiber remains his property throughout ginning and packaging and until the bale is sold.

The methods used in ginning greatly affect the quality of the cotton the grower has to sell, and consequently the price he gets for it. Good methods preserve the quality attained in other steps of production. Poor ginning methods can nullify gains that have been made by growing improved varieties of cotton and by using good cultural practices.

Changes in ginning requirements that have occurred since about 1930 have been more numerous and far reaching than those that occurred in the preceding 100 years. To solve the problems arising from these changes, the United States Department of Agriculture maintains three cotton ginning research laboratories, which are part of the Agricultural Engineer-

ing Research Branch of the Agricultural Research Service. The Branch also conducts research at a State-Federal ginning laboratory.

LOCATION AND EQUIPMENT

The United States Cotton Ginning Research Laboratories are in locations that were selected with a view to working with problems peculiar to different regions of the Cotton Belt. The oldest and largest laboratory is at Stoneville, Miss. It is headquarters for ginning research in the Midsouth. The laboratory at Mesilla Park, N. Mex., serves the irrigated areas of the West and the Southwest. The one at Clemson, S. C., serves the Southeast.

Each of these laboratories is on land that is owned by the Federal Government. Each is near a State experiment station where cooperative work in cotton production is carried on. Much of the cotton used in tests at the laboratories is provided by the experiment stations. Both the laboratories and the experiment stations employ engineers, scientists, and laboratory technicians who cooperate in practically all phases of research applicable to the cotton industry.

The State-Federal laboratory is located at the Oklahoma Cotton Research Station, Chickasha, Okla. It serves Oklahoma and adjoining sections of other States where machine stripping and rough hand harvesting are widely practiced. The Federal projects are conducted through Federal-State cooperation and financing.

Each of the laboratories is equipped with representative types of ginning machinery suitable to the region in which the laboratory is located. The laboratory equipment also includes bench-model saw-ginning units, roller-ginning units, and fiber-study facilities.

Conditions normally found at commercial gins are reproduced in the laboratories, but variations are included for test purposes.

Shop facilities are available to laboratory engineers, who construct experimental machines and equipment. Inventions are fully publicized; they are usually registered as public patents for the benefit of the cotton industry.

THE LABORATORIES

The laboratories have been host to delegations from practically all lands where cotton is grown. Most of these visitors come to this country under the auspices

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The United States Cotton Ginning Research Laboratory, Stoneville, Miss.

of their governments or of foreign-trade organizations in their countries. Groups, individual tourists, and officials have come from Pakistan, Turkey, India, Syria, Lebanon, and Israel; from the Sudan and other cotton-producing countries of Africa; from European countries that have cotton-growing colonies, including Great Britain, Belgium, France, Portugal, and Spain; from the West Indies; from Mexico and Central American countries; and from Colombia, Peru, Brazil, and Argentina.

The laboratories are also visited by teachers and agricultural students from various parts of the United States, by representatives of the textile industry, by manufacturers of ginning machinery and by the interested public. Some visitors stay in the vicinity a number of days to study laboratory operations and observe commercial and plantation gins at work.

The Laboratory at Stoneville, Miss.

The United States Cotton Ginning Research Laboratory, Stoneville, Miss. (near the town of Leland), was established in 1930 under an act of Congress authorizing ginning investigations. This laboratory is known throughout the world.

The laboratory cooperates with the Mississippi Delta Branch Experiment Station, which carries on the world's most intensive experiment and research program on cotton production. This station, the largest cotton experiment station in the United States, has pioneered in experiments with new varieties of cotton, improved cultural practices, and cotton-harvesting machinery.

Improved cottons are turned over to the Federal laboratory by the station for ginning and for subsequent tests to evaluate the various qualities of the fiber.

The Laboratory at Mesilla Park, N. Mex.

The United States Cotton Ginning Research Laboratory, Mesilla Park, N. Mex., has been in operation since 1950. It has a roller-ginning laboratory in addition to saw-ginning and fiber-study facilities. Much of the cotton used by the laboratory is supplied by the Agricultural Experiment Station of nearby New Mexico College of Agriculture and Mechanic Arts; the station has developed leading varieties of both upland and Pima cotton.

The United States Cotton Ginning Research Laboratory, Mesilla Park, N. Mex.

The laboratory and the experiment stations of New Mexico, Texas, Arizona, and California cooperate in research to determine how ginning requirements are affected by new varieties and by improved cultural, pest-control, and harvesting practices.

Problems receiving preferred attention at this laboratory are: How to condition, clean, and gin irrigated cotton harvested by machinery, without adversely affecting fiber quality; how to eliminate static electricity in gins; and how to destroy the pink bollworms that come to the gin in the cotton.

The laboratory is also seeking ways to improve the roller ginning of extra-long-staple American-Egyptian types of cotton. At present, roller ginning is the only satisfactory method to use for such cotton. This is because the teeth on saw gins form neps (knots) in the long, silky fibers and reduce the "staple length," which determines the grade of the cotton.

The Laboratory at Clemson, S. C.

The United States Cotton Ginning Research Laboratory, Clemson, S. C., was established in 1955 to serve the Southeastern States, where nearly 20 percent of the cotton in the United States is grown.

Personnel of the laboratory cooperate with the South Carolina Agricultural Experiment Station and with stations in the Southeast in conducting research on cultural practices, harvesting, and ginning.

The rapid conversion to newer mechanical and rough hand-harvesting methods throughout this region in recent years has multiplied ginning problems. Increased amounts of burs, stems, leaf fragments, and trash have necessitated more cleaning. Higher moisture content in the harvested cotton has necessitated more drying. This additional cleaning and drying may result in fiber damage. The laboratory is testing combinations of methods and equipment designed to overcome these difficulties.

Other problems under study at the laboratory are those that arise from conditions of plant growth and weather that are peculiar to this region. Marked differences in the height of plants, profusion of foliage, high moisture content of seed cotton, the presence of troublesome crabgrass in the fields—all create special harvesting and ginning difficulties.

Most of the cotton gins in the Southeast handle relatively small volumes, usually less than 1,000 bales per

season. Their survival depends on their ability to cope with economic and engineering problems that seem relatively unimportant to large operators.

RESEARCH ACCOMPLISHMENTS

The laboratories perform research on farm-to-gin hauling and storage, drying and cleaning at the gin, separation of seed from lint, and packaging. They also determine the effects on fiber quality of various conditions under which cotton is ginned. Their work has made it possible to maintain high quality in the fiber that goes into trade channels and to turn out better seed for planting and for commercial uses.

Laboratory services are available to growers, ginners, and manufacturers of ginning equipment who request help on specific engineering problems. Such problems are often used as "case studies" on which further research is based.

Growers, ginners, and persons in other segments of the cotton industry are informed of research developments through the Federal Extension Service of the United States Department of Agriculture and through Department publications.

Devices for Drying and Cleaning Seed Cotton

A major accomplishment of the research laboratories is the development of more efficient drying, cleaning, and conditioning machinery for machine-harvested and rough-handpicked cotton. Devices and processes recently developed make it possible for the gin to remove excessive amounts of moisture, trash, sticks, and green-leaf fragments from cotton that has been harvested by the rougher methods. No way has yet been found to eliminate the moisture or foreign matter in the field.

The following are among the drying and cleaning devices, already developed, that have proved practical at the gin.

Tower drier.—An early accomplishment of the Stoneville laboratory was the development of the vertical, or tower, drier. This practical method of seed-cotton drying made each day a "sunny day" at the gin. Progress from inferior to superior ginning resulted, and several commercial applications of the process ensued.

Recipro-cleaner.—This cleaner removes motes and part of the gin trash. The cotton fibers, held in the grip of saw teeth, are beaten against knife-edge bars

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Harvesting cotton by handpicking.

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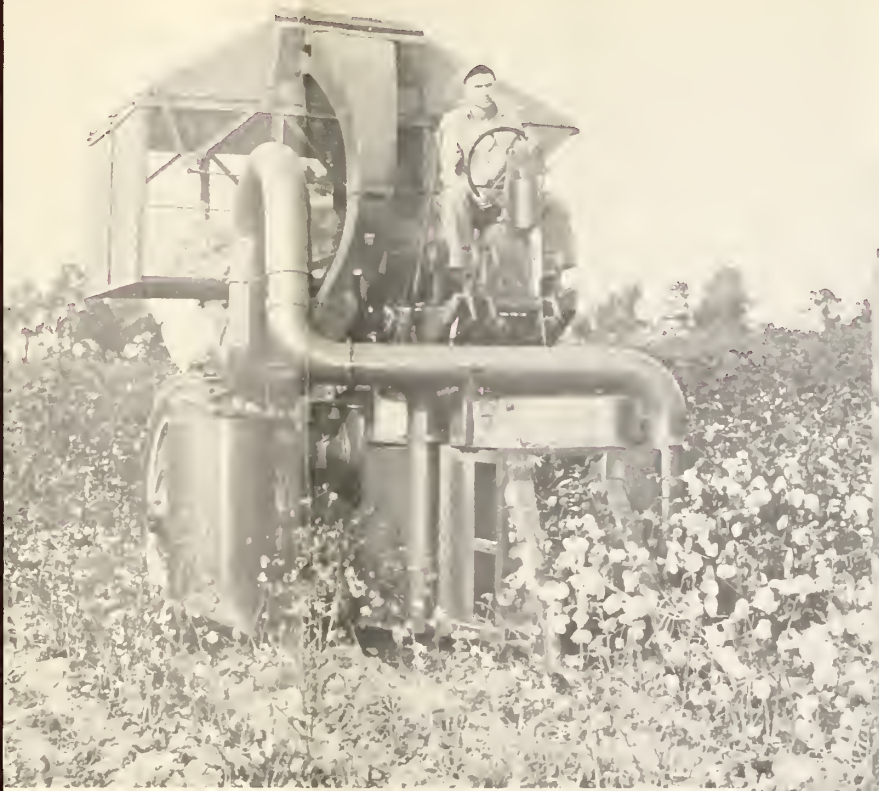
The United States Cotton Ginning Research Laboratory,

Clemson, S. C.



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Harvesting cotton with mechanical stripper.

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Harvesting cotton with spindle type picker.

that move from side to side. This beating, or flailing, loosens and removes the motes and some of the foreign material from the fibers.

Lint cleaners.—Lint cleaners are machines that remove leaf fragments and small pieces of trash that remain entangled in cotton fiber after ginning but before the cotton is pressed into bales.

Efficient types of lint cleaners have been developed by the United States Cotton Ginning Research Laboratories and by commercial firms. Several types have proved so efficient that they have become standard gin equipment in areas where cotton is harvested by rough hand or mechanical methods.

Work on the original lint-cleaning process that led to the development of these devices was begun by the laboratory at Stoneville in 1938.

Stick remover.—This machine removes sticks (pieces of stalk), stems, burs, and other trash from cotton. The machine's basic operation consists of centrifugal action of rotary saws. This action throws out the sticks and flails the cotton fibers against grid bars so that other trash is beaten loose.

The stick remover was invented at the Stoneville laboratory. It was developed primarily for use on machine-stripped cotton harvested in Oklahoma and adjacent sections of other States.

Green-boll and rock trap.—This trap removes green bolls and other foreign matter (including tramp metal) from seed cotton. Removal of foreign matter results in less wear and tear on ginning machinery and less loss of time from breakdowns caused by clogging of moving parts of the gin by sticky bolls.

A secondary purpose of the trap is to reduce the number of gin fires by preventing causes of fires—friction resulting from chokages, and sparks from metal objects.

When the trap is equipped with an electromagnet, it is even more effective in preventing fires because the magnet removes more of the tramp metal that may produce hazardous sparks.

The trap is so located in the gin that the seed cotton passes through it before reaching the cleaning equipment. The cotton is floated by means of an air current channeled through a pipe of prescribed dimensions. The air current must have sufficient velocity to float the cotton on and up through the trap, while heavy bolls, rocks, and small pieces of metal drop into a hopper.

Other Developments

Successful research has been accomplished on other mechanical factors, including saw-tooth design, picker-roller speed, rib spacing, doffing adjustment, feed control, roller-gin modernization, better bale-compressing methods, and pink bollworm destruction at the gin. Faster and more efficient ginning and packaging have resulted. The following are a few of the devices and methods that have been developed.

Higher saw speeds.—The laboratory at Stoneville has demonstrated that the use of higher saw speeds in conjunction with loose seed rolls gives smoother ginning and better seed cleaning. This, in turn, increases the ginning capacity of the machinery and results in greater bale weight and value.

Bulk seed-cotton feed control.—This device controls the rate at which seed cotton is fed into the gin and obtains uniform flow of cotton through the system. By so doing, it increases the efficiency of the overhead ginning machinery, including driers, clean-

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Stick remover installed in gin.

ers, and extractors. It also reduces loss of ginning time from mechanical breakdowns.

Mechanical feeding of cotton without adequate control reduces the effectiveness of the drying and cleaning equipment. Costly chokages often result. Large quantities of cotton sometimes accumulate in the overflow bins and create a fire hazard.

Modernization of the roller gin.—Roller ginning, which is necessary to preserve the quality of extra-long-staple cotton, is a slow, primitive process. It requires considerable manual work, including hand feeding of seed cotton into the gin.

At some gins in the United States, efficient new methods have been incorporated in the roller-ginning process. Pneumatic feeding of the cotton, artificial drying, and improved cleaning methods, including the lint-cleaning process, are among the improvements.

The improved methods also make it possible to roller gin machine-harvested extra-long-staple cottons without damaging the fine, silklike fibers. Previously, such cottons had to be handpicked.

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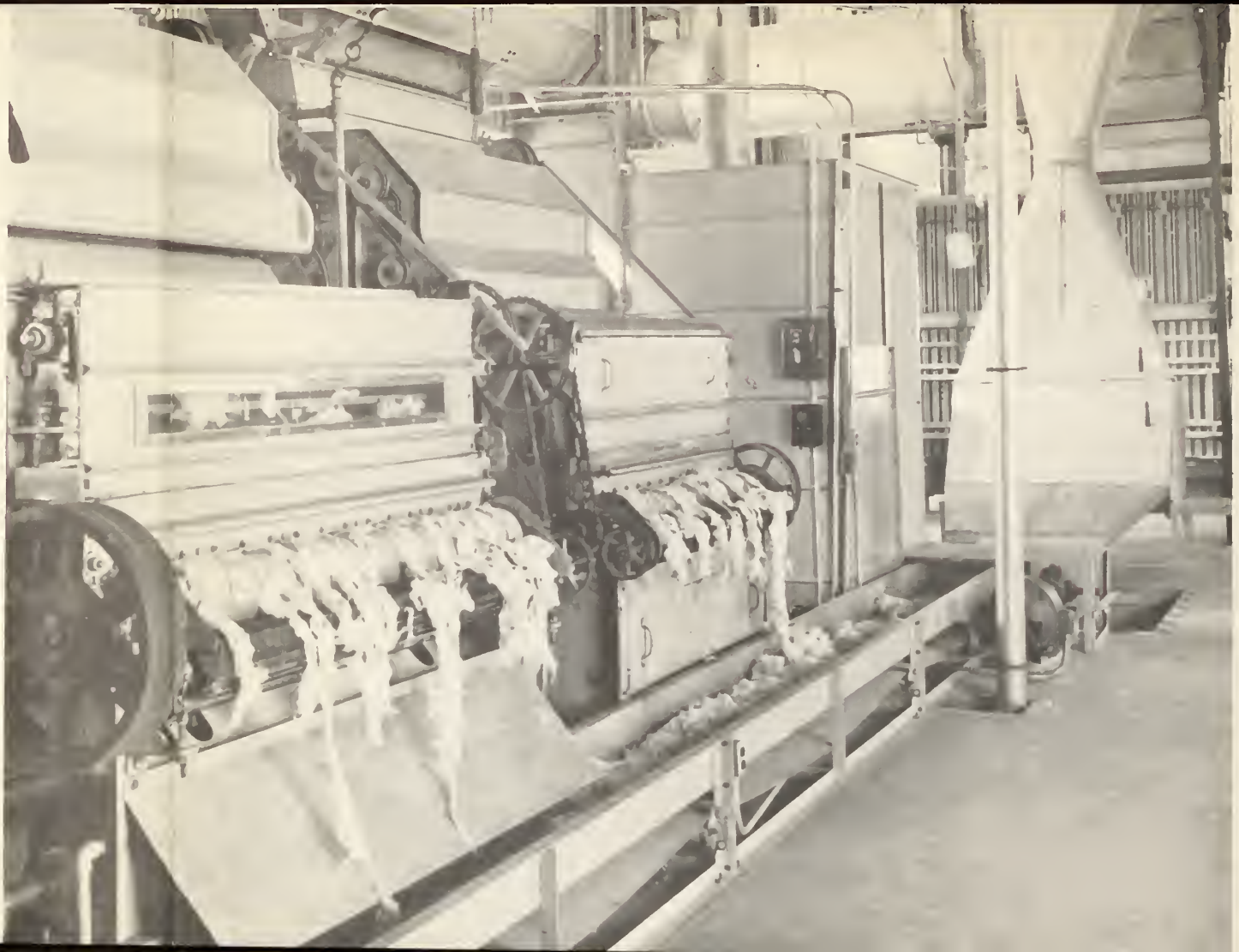
Green-boll and rock trap.



The saving of time at the gin and the machine harvesting of the extra-long-staple cottons combine to reduce production costs.

Standard-density gin press.—This machine compresses ginned cotton fiber to a density of 20 to 30 pounds per cubic foot. This contrasts sharply with the 10 to 12 pounds obtained with older gin equipment. Substantial savings in storage and shipping costs result from this added compression at the gin.

The press has proved of greatest value in the West and Southwest, where gins are located long distances from compresses or cotton mills. Many gins in these regions have installed this device as standard equipment.

Pink bollworm destruction in cotton at the gin.—Research is finding ways to deal with pink bollworms in the seed cotton that comes to the gin. Trash fans of certain types and sizes, operating at specific speeds, destroy these pests in the gin trash. When this is done, the trash need not be burned, but may be returned to the fields as mulch. Pink bollworms in cottonseed-oil mill waste can be destroyed in a similar way. These findings are the result of research at the Mesilla Park (N. Mex.) laboratory in cooperation with the Entomology Research Branch, Agricultural Research Service.

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ller gin with improved seed-cotton and lint-cleaning machinery.

Recent experience has shown that other ginning machinery and equipment, such as the drier, lint cleaner, stick remover, and improved gin stand, also kill pink bollworms brought into the gin with cotton.

Now that combinations of ginning machinery are killing up to 100 percent of the pink bollworms, the State and Federal regulatory officials have dispensed with requirements in some areas for heat sterilization of cottonseed at the gins, thus saving the growers and ginners as much as $1.5 million annually.

NEED FOR CONTINUING RESEARCH

Problems in cotton ginning may arise from need for machinery improvements in ginning processes; or they may result from mechanical harvesting or other factors outside the gin.

Many problems have already been solved or partly

solved through research carried on by the United States Cotton Ginning Research Laboratories and by improvements made by manufacturers of ginning machinery. Other problems, old and new, require additional study and research. The following are typical.

Optimum Moisture in Seed Cotton

Maintenance of a correct percentage of moisture in seed cotton is necessary to insure the most productive operation of the gin.

Overdrying during ginning is a problem that has developed with the mechanization of harvesting. Devices and processes used to remove excessive moisture in machine-harvested cotton sometimes cause overdrying. This excessive moisture comes from leaf fragments and from water applied to the picking spindles of the mechanical pickers to increase harvesting efficiency and to help in keeping the spindles clean.

Cotton brought to gins in arid regions is often so dry that damage to fibers may occur during ginning. The elaborate drying and cleaning machinery in the modern ginhouse tends to overdry it further.

Ways to restore moisture in required amounts to overdried seed cotton are being studied at the Stoneville and Mesilla Park laboratories.

Better Gin-Stand Performance

Work is under way at the laboratories to develop an improved gin stand that will give better general performance, including a reduction in neps and prevention of fiber breakage. This work, when completed, may open the way for toothed (or saw) ginning of extra-long-staple cotton that can now be handled only by roller ginning.

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tandard-density press.

PUBLIC PATENTS

Public patents issued on equipment and improvements developed and tested at the United States Cotton Ginning Research Laboratories assure availability of these inventions to ginners in all parts of the Cotton Belt. A partial list follows.

Number	Title	Date granted
1,695,991	Seed Cotton Drying Apparatus....	Dec. 18, 1928
1,707,929	Process and Apparatus for Drying Seed Cotton.	Apr. 2, 1929
1,707,930	Seed Cotton Drying Apparatus....	Apr. 2, 1929
1,827,183	Process and Method for Ginning Cotton With Air-Blast Gins.	Oct. 13, 1931
1,871,773	Apparatus for Drying Seed Cotton.	Aug. 16, 1932
2,002,974	Fractionation Device and Method for Employing the Same.	May 28, 1935
2,045,064	Device for Culling and Grading Seed Cotton.	June 23, 1936
2,078,309	Apparatus for Drying Seed Cotton.	Apr. 27, 1937
2,189,099	Drying Systems for Seed Cotton..	Feb. 6, 1940
2,196,613	Apparatus for Determining the Percentage, by Weight, of Linters on Cottonseed.	Apr. 9, 1940
2,225,397	Cotton Fan.....	Dec. 17, 1940
2,264,910	Integrator for Circular Ordinates.	Dec. 2, 1941
2,339,394	Baler.....	Jan. 18, 1944
2,365,496	Moisture Measuring Instrument..	Dec. 19, 1944
2,569,501	Lint Cotton Cleaner.....	Oct. 2, 1951
2,580,451	Stick Remover for Seed Cotton Extracting Machines.	Jan. 1, 1952
2,634,461	Cotton Gin Cleaner (Recipro).....	Apr. 14, 1953
2,651,312	Cotton Turbocleaner Process.....	Sept. 15, 1953
2,735,226	Method and Apparatus for Treating Cottonseed.	Feb. 21, 1956

PUBLICATIONS

Results of work at the United States Cotton Ginning Research Laboratories, as well as recommendations by their engineers and technologists, are set forth in numerous United States Department of Agriculture publications. A partial list follows. Except as noted, free copies may be obtained by writing to the United States Department of Agriculture, Washington 25, D. C.

Agriculture Handbook 99, Modernizing Cotton Gins.

Leaflet 151, Effects of Feeds and Saw Speeds on Cotton Turn-Out and Quality.

Leaflet 169, Preventing Gin Damage to Cotton.

Leaflet 216, Cotton-Gin Maintenance.

Leaflet 217, Cotton Ginning for Pure-Seed Preservation.

Circular 736, The Packaging of American Cotton and Methods for Improvement.

Circular 858, The Flow-Through Lint-Cotton Cleaner.

For sale only. 10 cents. To obtain a copy, send order and remittance to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. *Do not send to the Department of Agriculture for this publication.*

Circular 922, Cleaning Cotton at Gins and Methods for Improvement.

Circular 949, Effects of Electrical Bonding and Grounding on Static Generation and Elimination in Cotton Gins.

Circular 973, Foreign-Matter Trap for Cotton Gins—A Device for the Removal of Green Bolls and Other Heavy Objects From Seed Cotton at the Gin.

Circular 974, An Improved Moting System for Cotton Gins.

Miscellaneous Publication 527, Packing of Cotton at Gins for Uniform Density.

This bulletin was prepared by the Agricultural Engineering Research Branch, Agricultural Research Service. It supersedes Miscellaneous Publication 445, The Work of the United States Cotton Ginning Laboratory.

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Loading bales of cotton on Mississippi River barges.